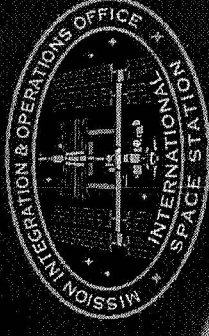
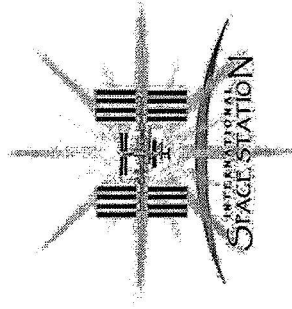


# Internal Cargo Integration

Angela Hart/0C4

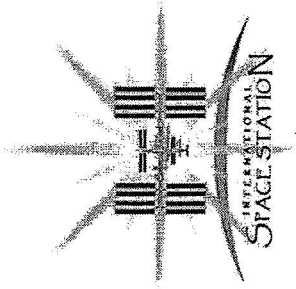
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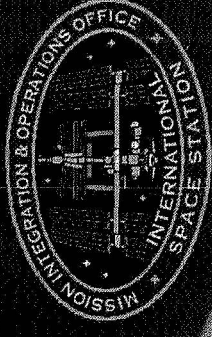
# Overview

- Typical Cargo for Launch/Disposal
  - Cargo Accommodations
    - CTB, M1/M2, M3
  - Standard Non-Packed Cargo for Launch/Disposal
    - Food Containers
    - Waste Containers
    - Large ORUs – Hardmounted
- Cargo Delivery Requirements
- Cargo Return Requirements
  - Typical Cargo for Return
- Vehicle On-Orbit Stay Time

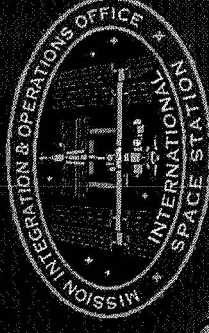
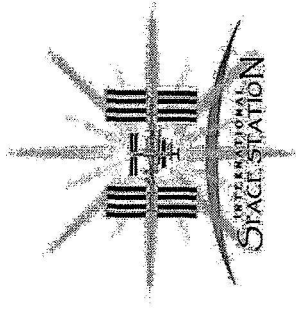




# Typical Cargo for Launch/Disposal



- Cargo Accommodations
  - Cargo Transfer Bags (CTB)
  - M1/M2/M3 Bags
- Standard Non-Packed Cargo for Launch/Disposal
  - Large ORUs –
    - Hardmounted for Launch
    - Strapped/other mounted for Disposal
  - Food Containers
  - Waste Containers

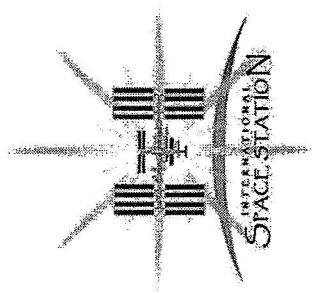


# Cargo Transfer Bag (CTB)

- Cargo Transfer Bags (CTBs) are Nomex stowage bags that contain removable, reconfigurable dividers used for packaging cargo for launch, disposal or return.
- CTBs are available in half, single, double, and triple sizes.
- Each configuration has a zipper closure and a removable mesh netting restraint system located inside of the CTB.

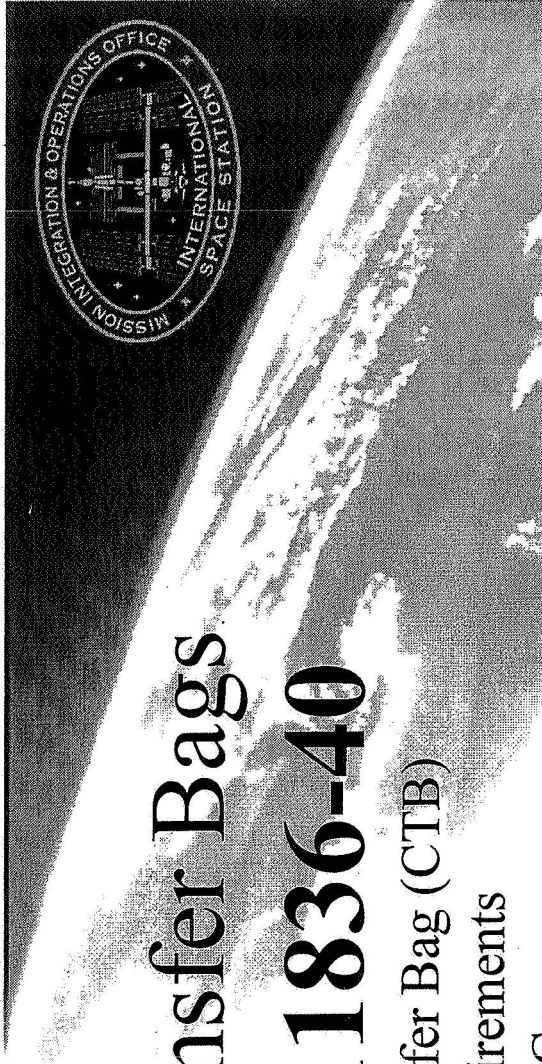
CTB	Approximate Size (external dimensions) L x W x H [cm (in.)]	Maximum Load Strapped kg (lbs)	Maximum Load Locker kg (lbs)
SEG33111836 Half (1/2x)	24.8 cm x 42.5 cm x 23.5 cm (9.75" x 16.75" x 9.25")	13.61 (30)	27.22 (60)
SEG33111837/838 Single (1x)	50.2 cm x 42.5 cm x 24.8 cm (19.75" x 16.75" x 9.75")	27.22 (60)	45.36 (100)
SEG33111839 Double (2x)	50.2 cm x 42.5 cm x 50.2 cm (19.75" x 16.75" x 19.75")	54.43 (120)	81.65 (180)
SEG33111840 Triple (3x)	74.9 cm x 42.5 cm x 50.2 cm (29.5" x 16.75" x 19.75")	81.65 (180)	81.65 (180)



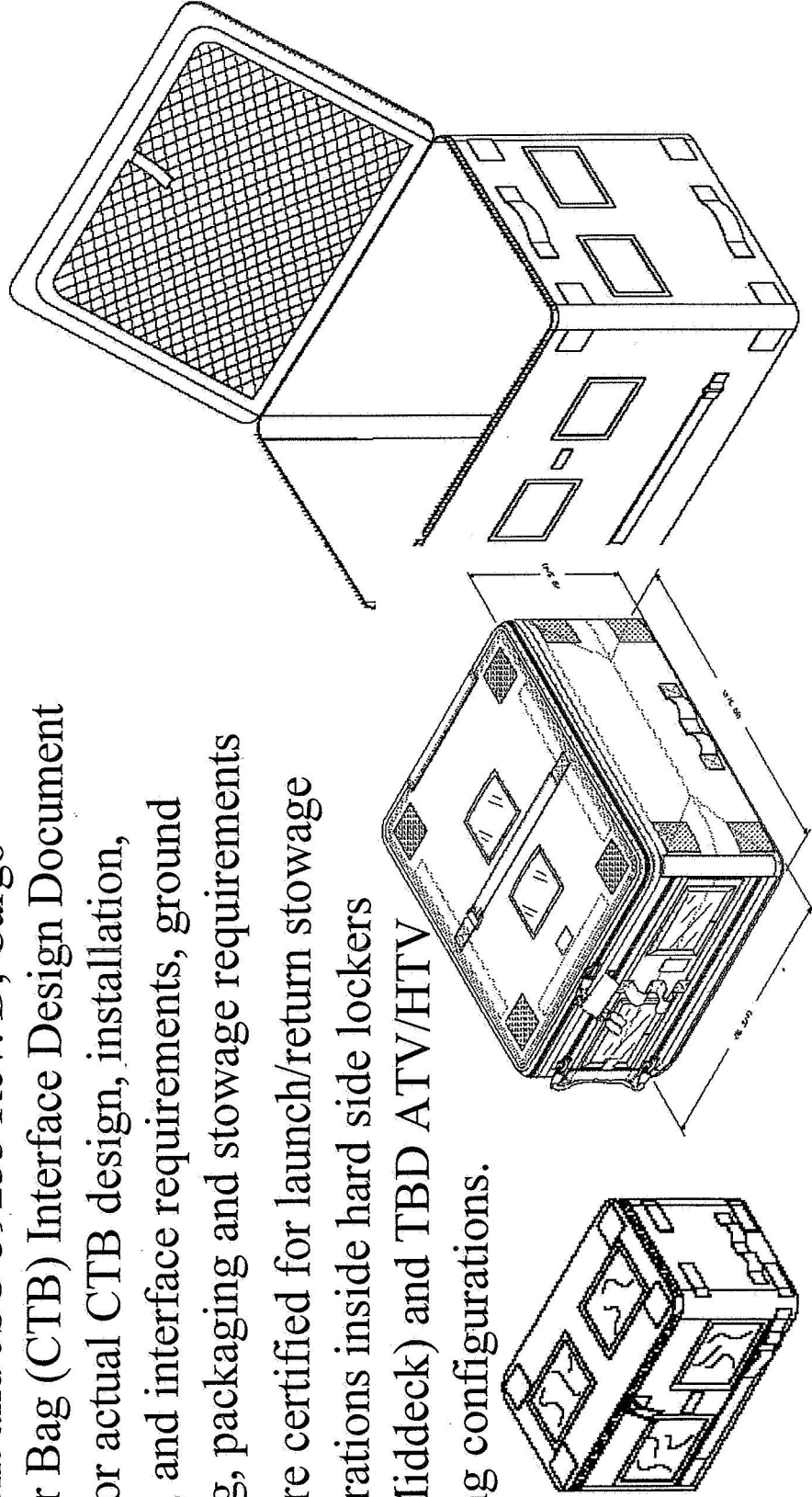


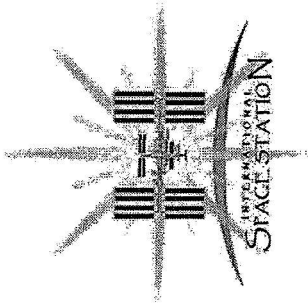
# Cargo Transfer Bags

## P/N 33111836-40

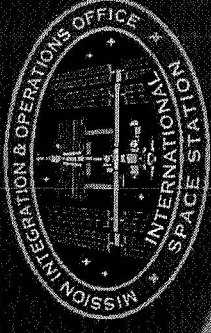


- Reference JSC 39207, Cargo Transfer Bag (CTB) Certification and Acceptance Requirements Document and JSC-39233 Rev. D, Cargo Transfer Bag (CTB) Interface Design Document (IDD) for actual CTB design, installation, volume, and interface requirements, ground handling, packaging and stowage requirements
- CTBs are certified for launch/return stowage configurations inside hard side lockers (RSR/Middeck) and TBD ATV/HTV strapping configurations.



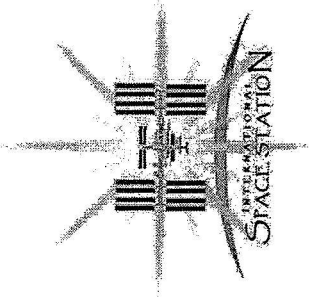


# Historical CTB Weights

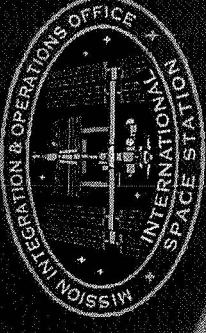


CTB	Total Bags Used	Bag Tare Kg (lbs)	Cargo Avg. Kg (lbs)	Crew Provision Kg (lbs)
Half	239	1.0 (2.2)	5.13 (11.3)	5.07 (11.2)
Single	223	1.81 (4.0)	10.26 (22.6)	9.42 (20.8)
Double	21	2.04 (4.5)	20.51 (45.2)	N/A
Triple	15	2.81 (6.2)	30.76 (67.8)	N/A





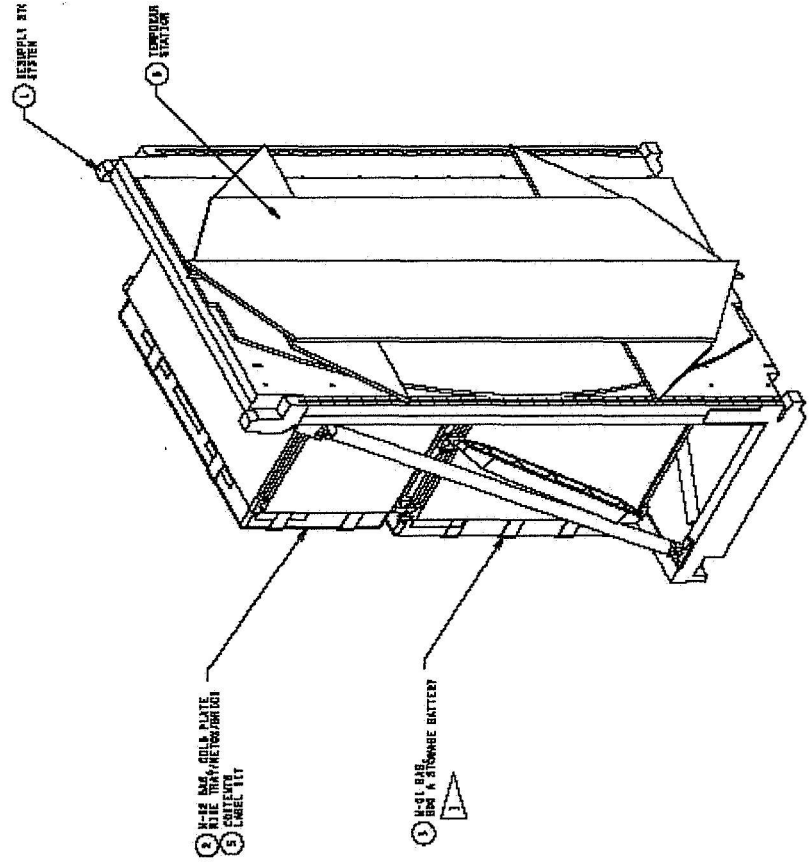
# Sample Oversized Items for Launch



- Hardmounted Items
  - Items requiring specific FSE for hardmount to carrier structure
    - TESS, AREC, and Heat Exchanger
- M01/M02/M03 Packed Bag Items
  - Items that can fit weight, cg and dimensionally in oversized bag accommodations.
  - Allows for later modeling and less cost in the development of FSE
  - CDRA, Elektron, TVIS Chassis

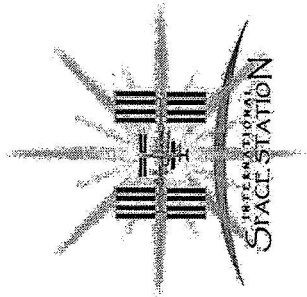


**Dimensions: 78" x 40" x 6.7"**  
**Mass: 89 lbs**

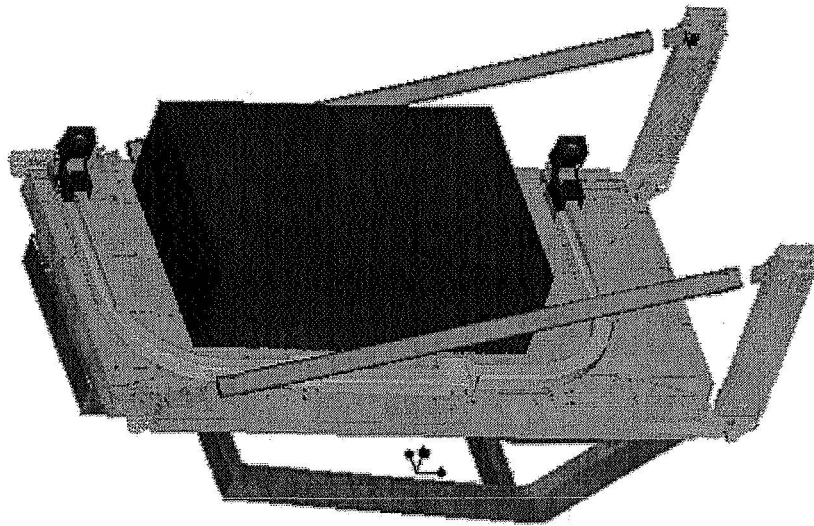
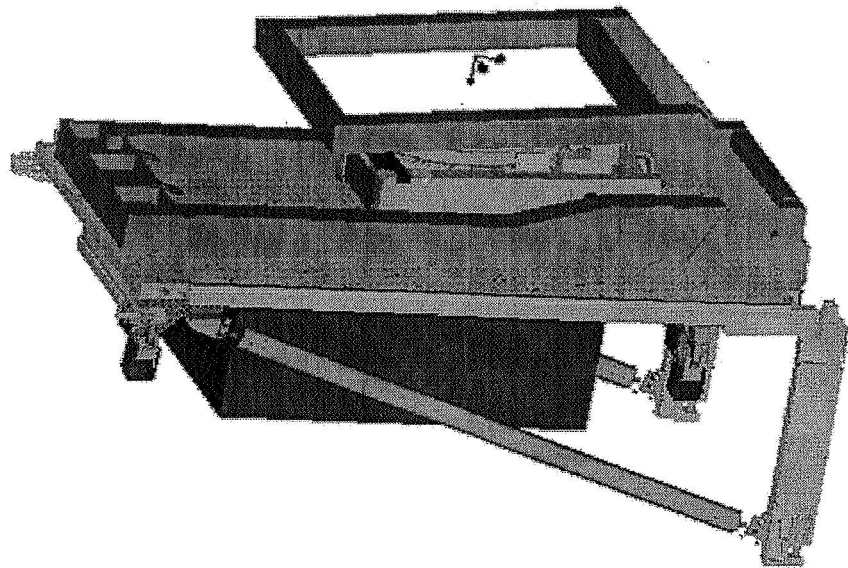


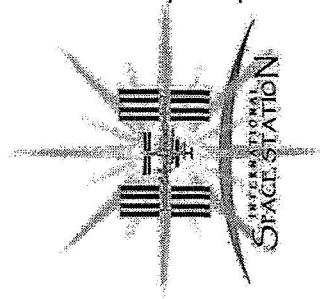
LAUNCH CONFIGURATION  
-305 ASSY





# Example Oversized Item ARED (Hardmount)



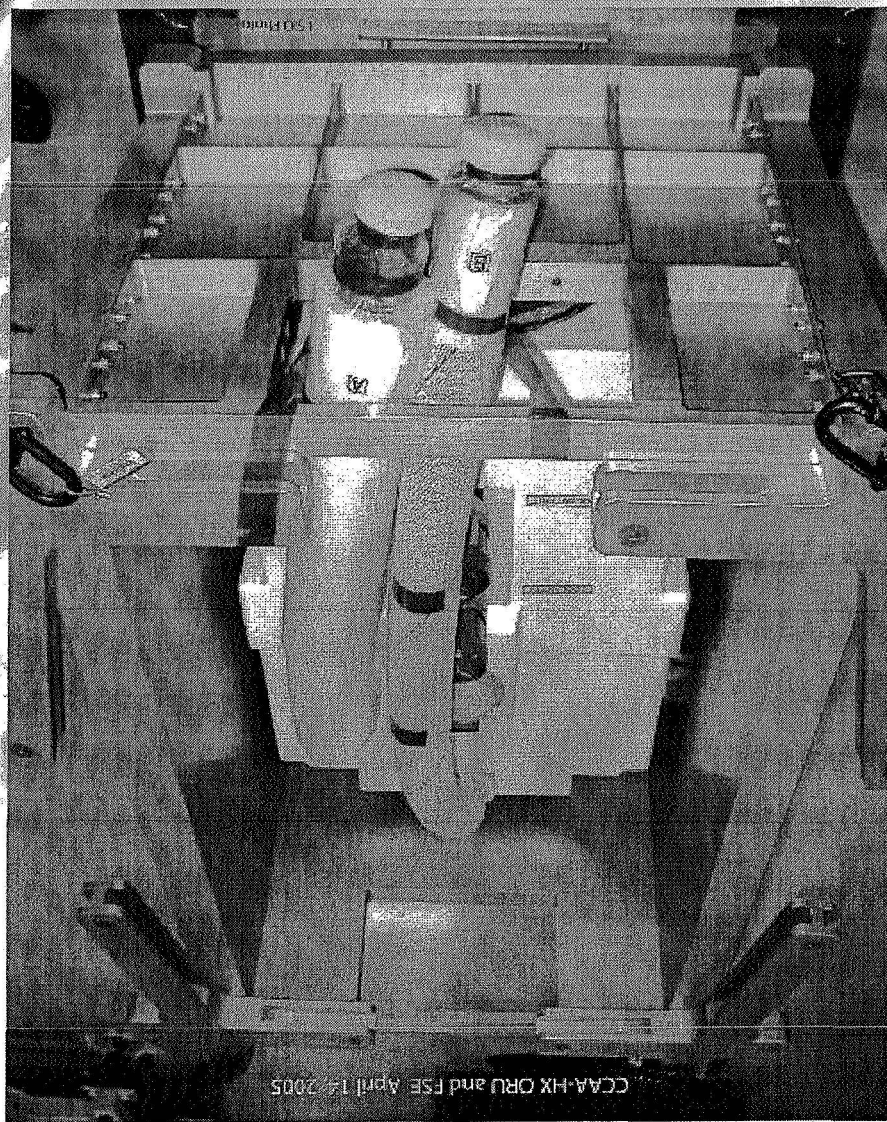


# Example Oversized Item

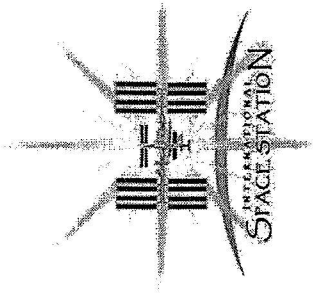
## HX and FSE

Dimensions: 38.5" x 24.5" x 17.5"

Mass: 116 lbs



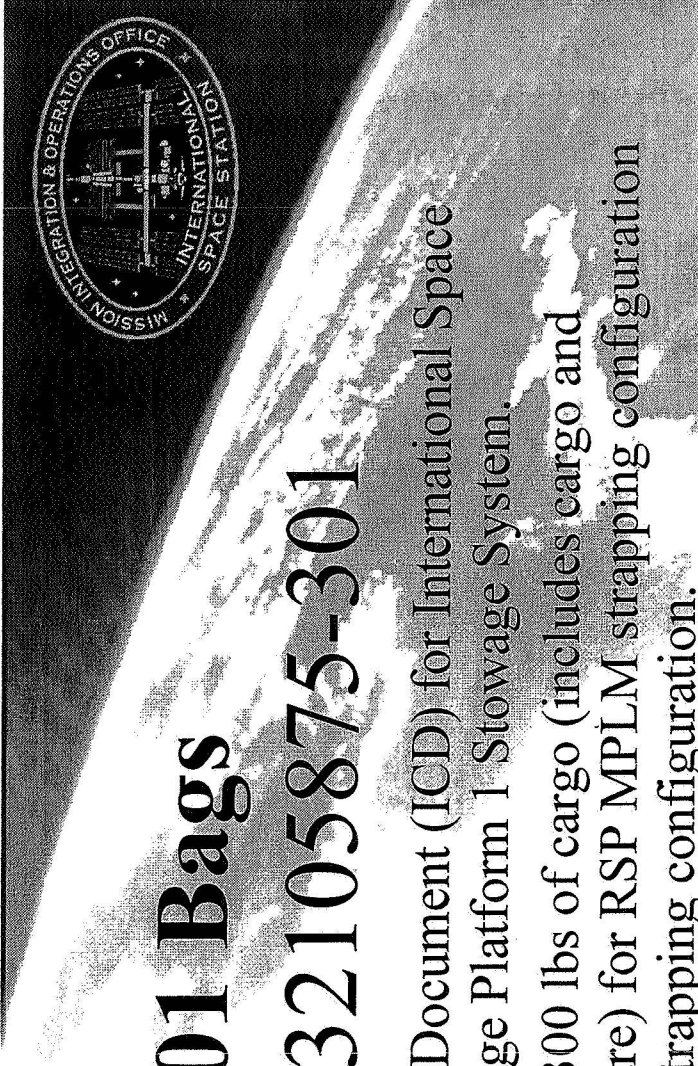
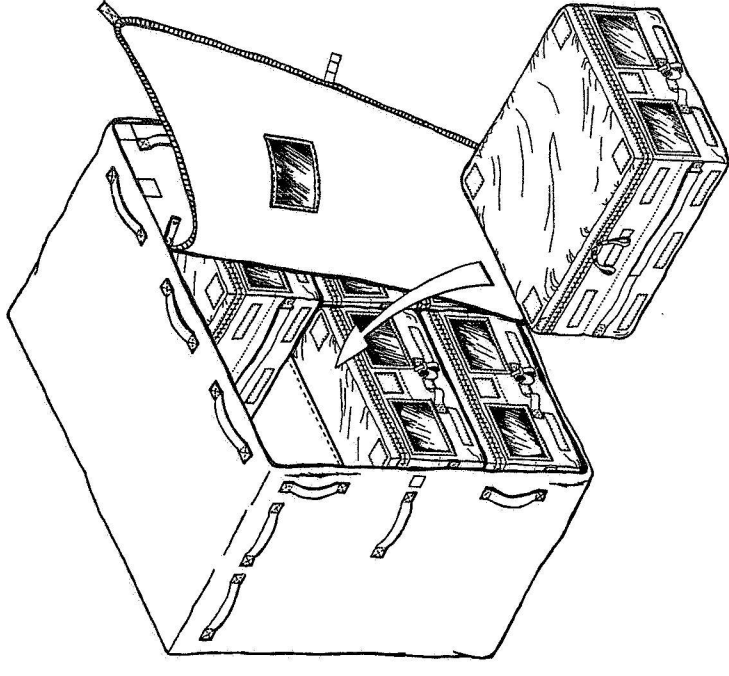


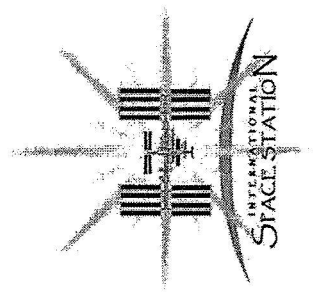


# M01 Bags

## P/N SEG32105875-301

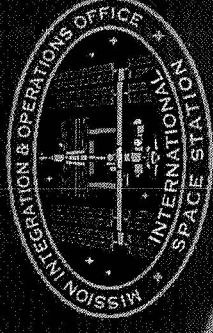
- JSC 28169, Interface Control Document (ICD) for International Space Station (ISS) Resupply Stowage Platform 1 Stowage System.
- M01 bag is certified to carry 300 lbs of cargo (includes cargo and associated installation hardware) for RSP MPLM strapping configuration and TBD lbs for ATV/HTV strapping configuration.
- Weight 10.64 lbs (empty bag).
- Volume of M01 bag is 13 ft<sup>3</sup>.
- A total of 6 Cargo Transfer Bag Equivalents (CTBEs) can be stowed inside an M01 bag.
- The external dimensions are:  
35.3" (W) x 21.0" (D) x 32.2" (H).



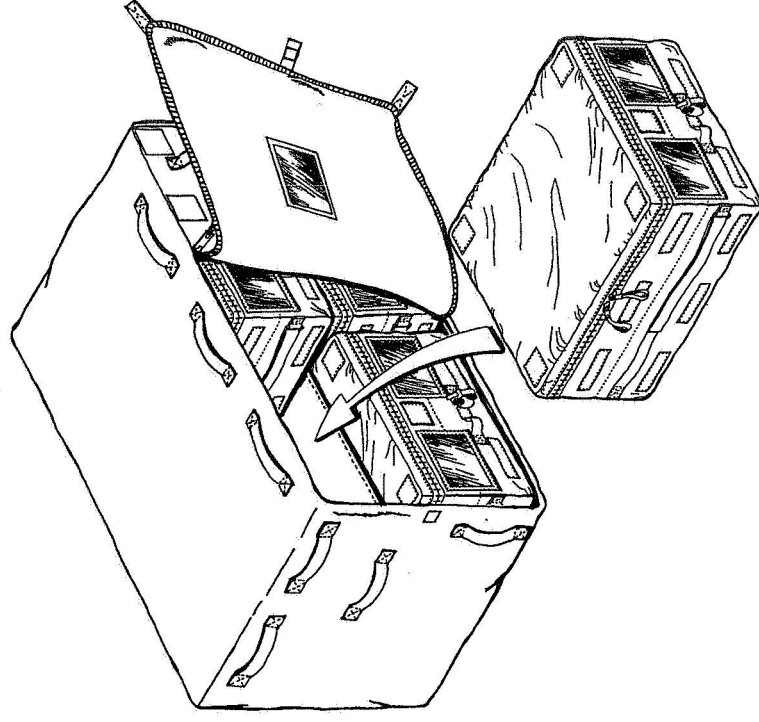


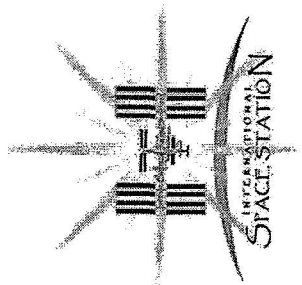
# M02 Bags

P/N SEG32105876-301



- JSC 28169, Interface Control Document (ICD) for International Space Station (ISS) Resupply Stowage Platform 1 Stowage System.
- M02 bag is certified to carry 90.8 kg (200 lbs) of cargo (includes cargo and associated installation hardware) for RSP MPLM strapping configuration and TBD lbs for ATV/HTV strapping configuration
- Weight 6.83 lbs (empty bag).
- Volume of M02 bags is 8 ft<sup>3</sup>.
- A total of 4 CTBEs can be stowed
- inside an M02 Bag.
- The external dimensions are:  
35.3" (W) x 21.0" (D) x 20.0" (H).



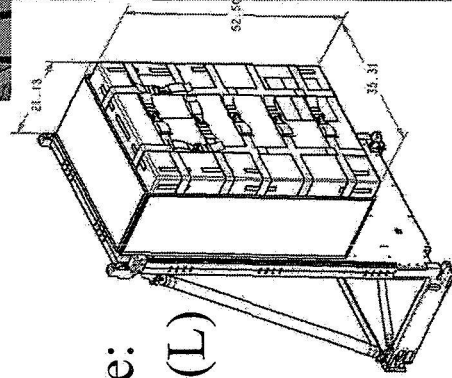
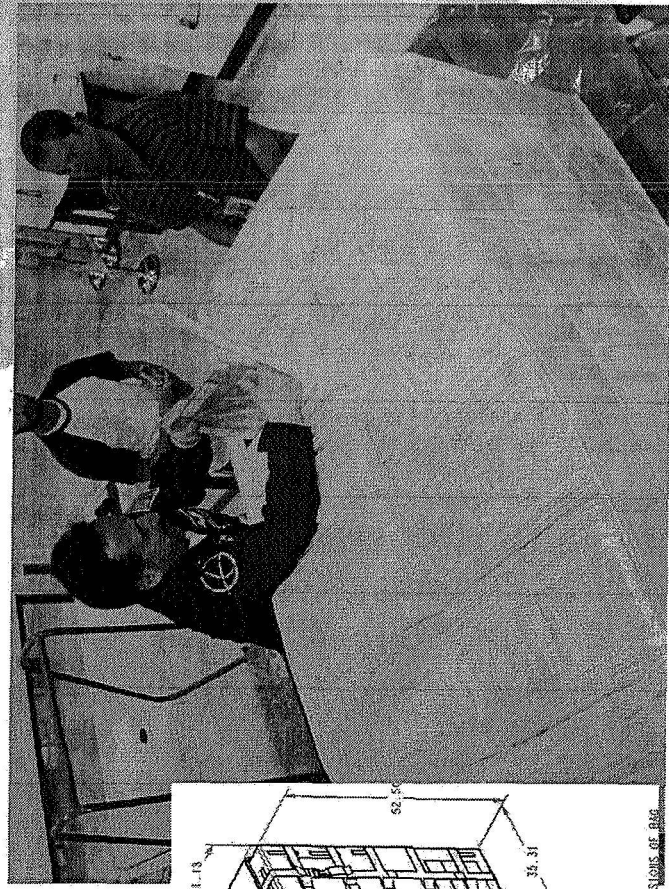


# M03 Bags

## P/N 33117683

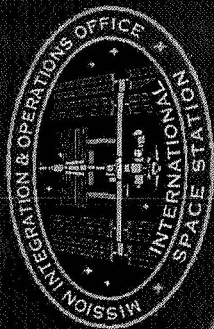


- JSC 28169, Interface Control Document (ICD) for International Space Station (ISS) Resupply Stowage Platform 1 Stowage System.
- M03 bag is certified to carry 226.8 kg (500 lbs) of cargo (includes cargo and associated installation hardware) for RSP MPLM strapping configuration and TBD lbs for ATV/HTV strapping configuration.
- Weight 16.5 lbs (empty bag).
- Volume of M03 bags is 22.0 ft<sup>3</sup>.
- A total of 10 CTBEs can be stowed
- inside an M03 Bag.
- The external dimensions are:  
35.3" (W) x 21" (D) x 52.5" (L)

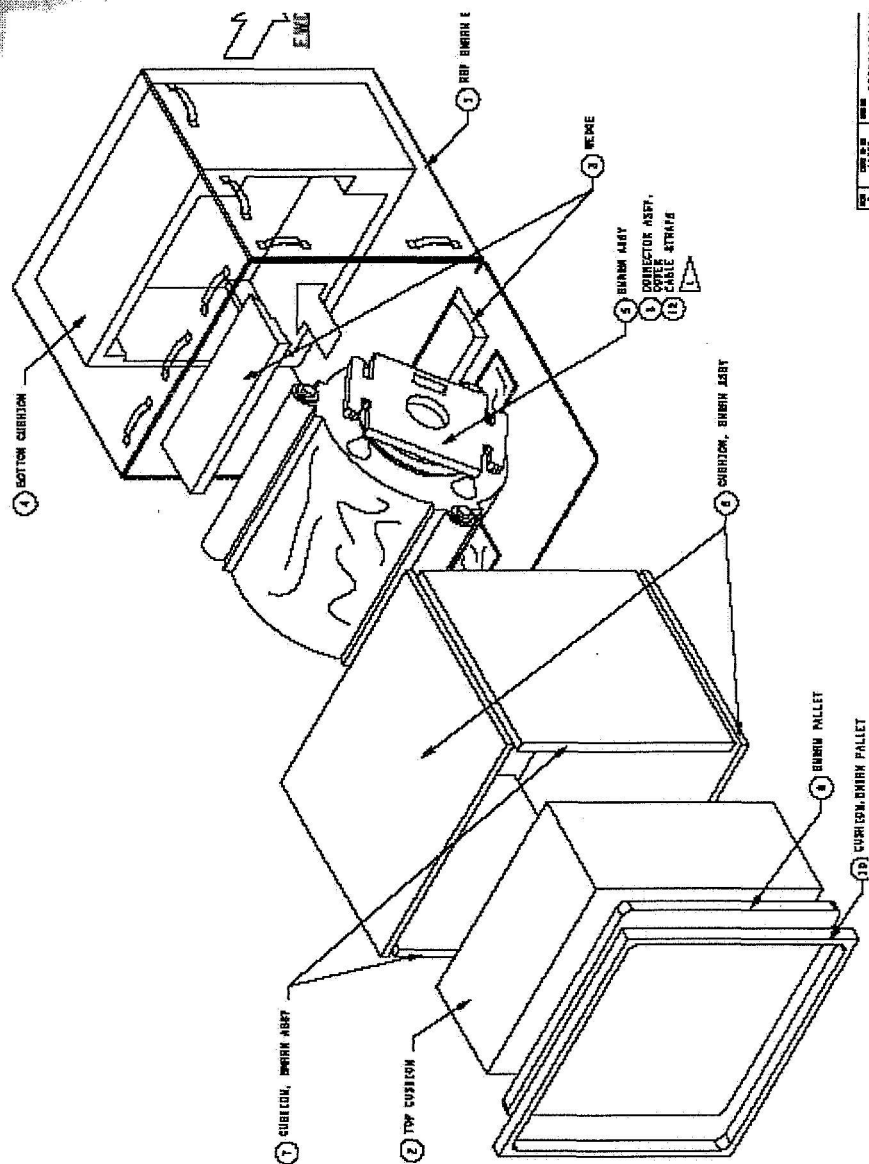


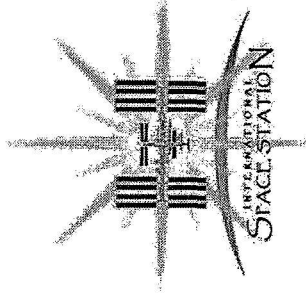
EXTERIOR DIMENSIONS OF BAG





**Dimensions: 24.5" x 30" x 30"**  
**Mass: 165 lbs**



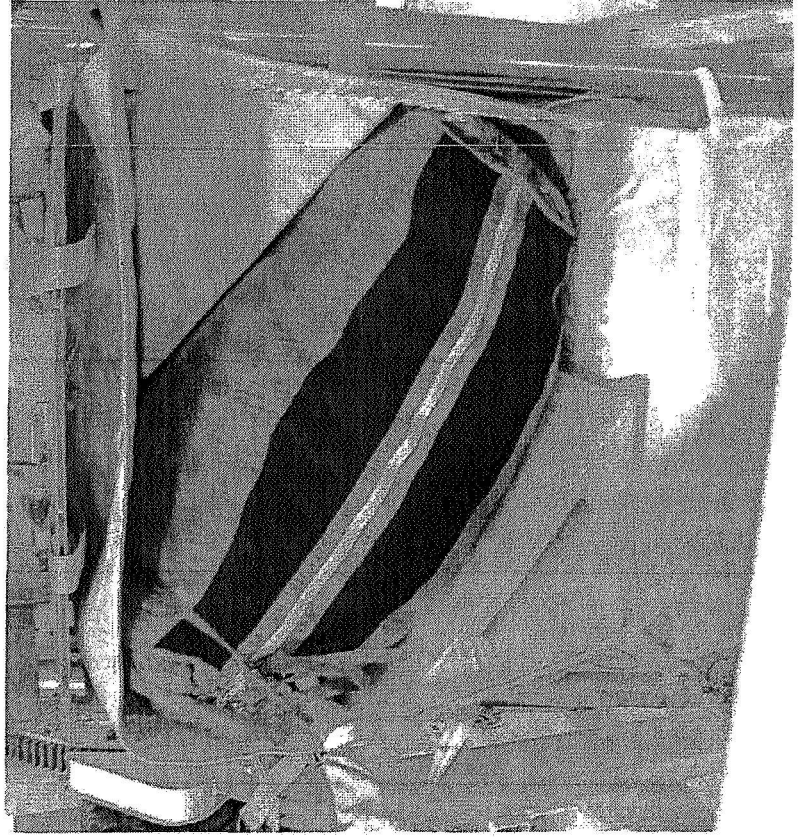
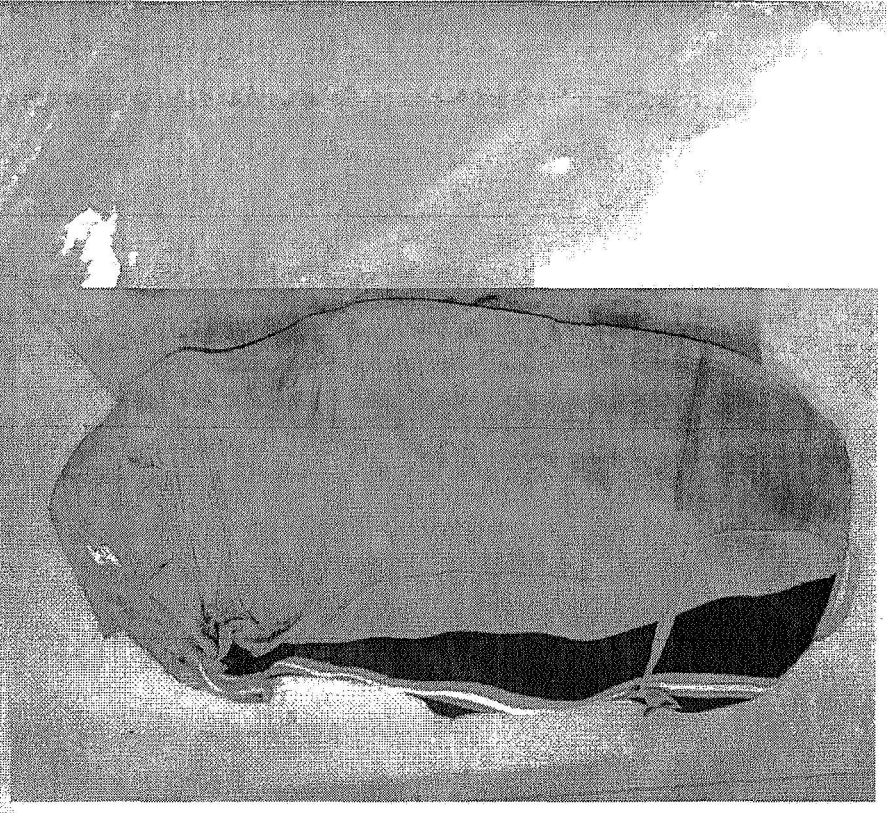


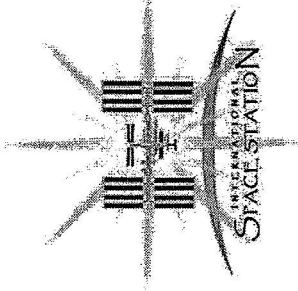
# Example Oversized Item

## IELK (M1 Bag)

**Dimensions: 43.7" x 20.5" x 16.3"**

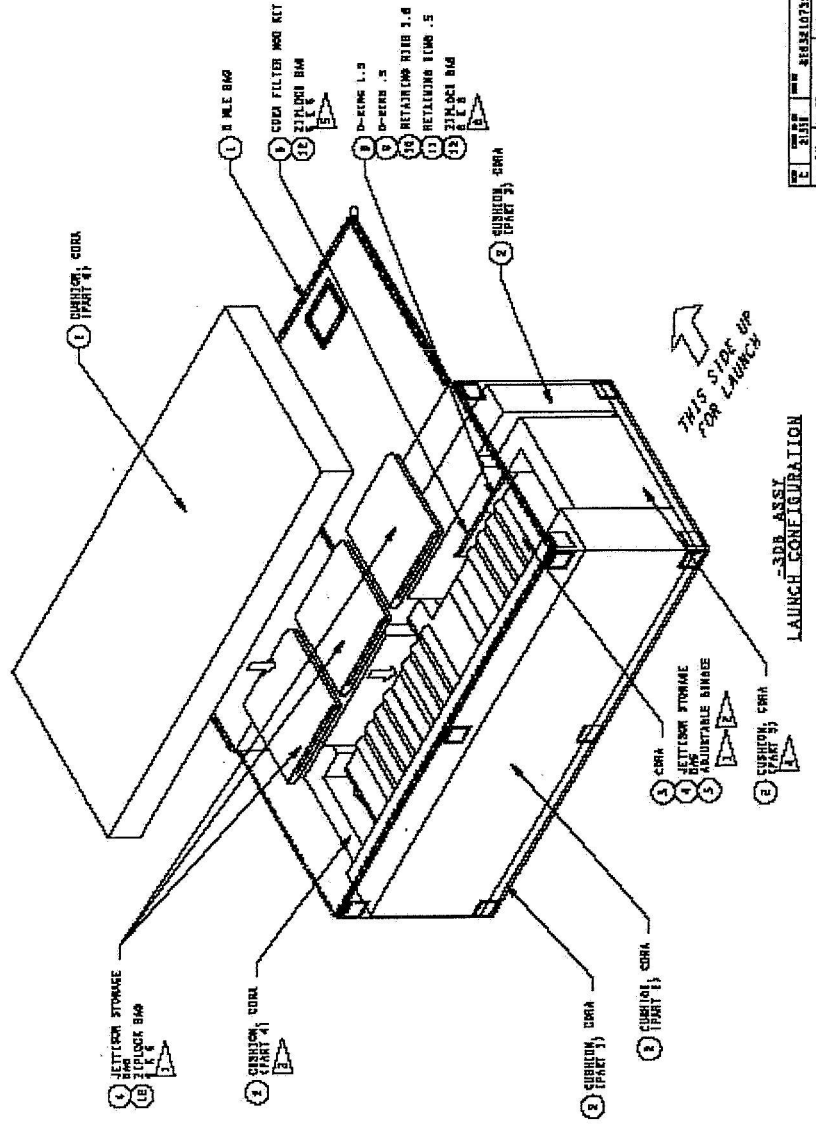
**Mass: 79.4 lbs**



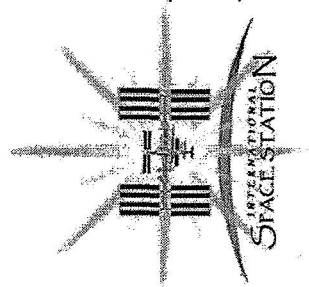


# Example Oversized Item CDRA (M1 Bag)

Dimensions: 42.5" x 12.0" x 10.0"  
Mass: 100 lbs





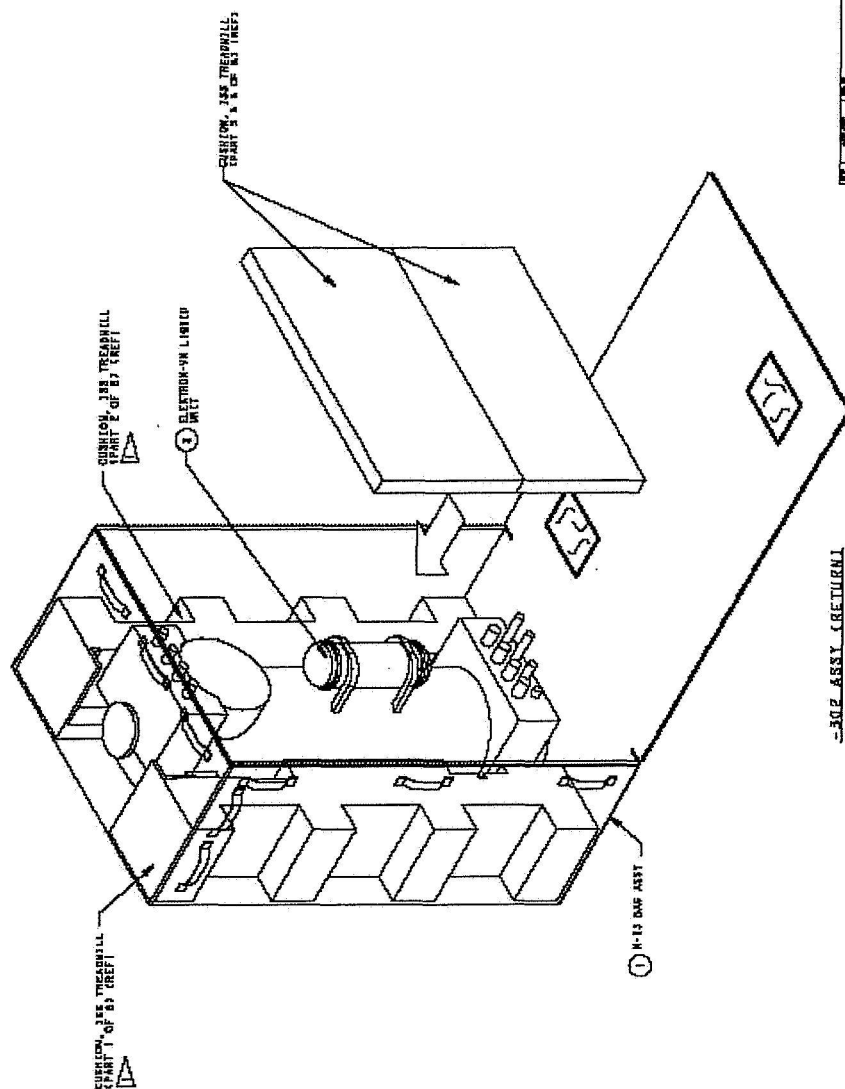


# Example Oversized Item

## Elektron (M03 Bag)

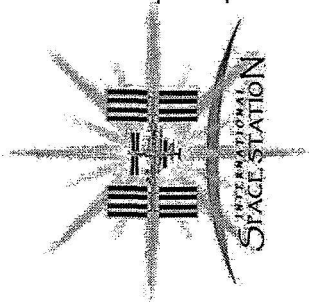
Dimensions: 49.8" x 13.4" (diameter)

Mass: 350 lbs



-302 ASSY (RETURN)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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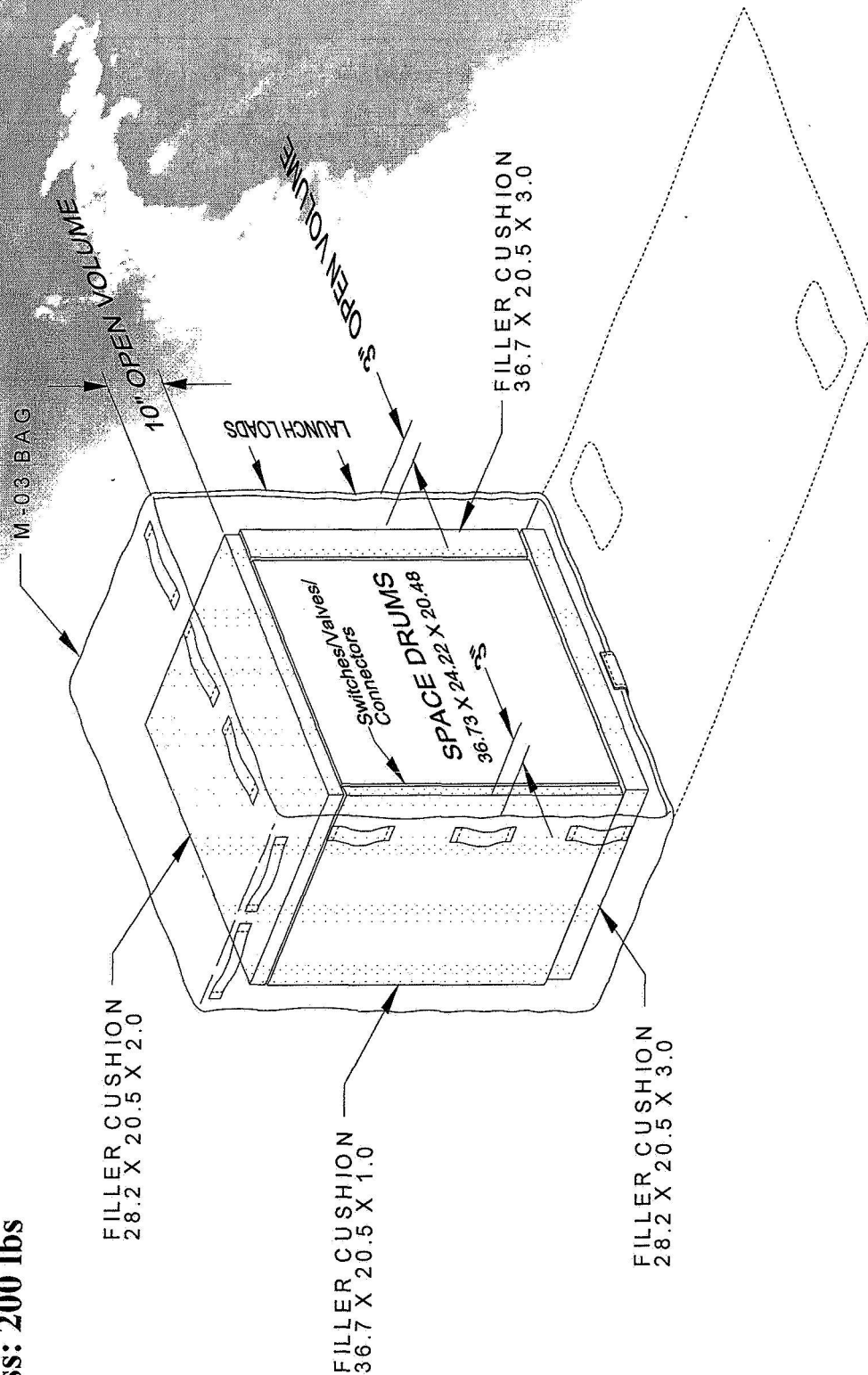
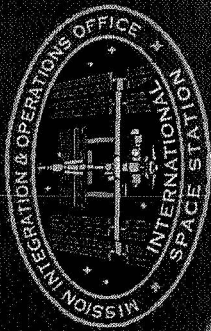


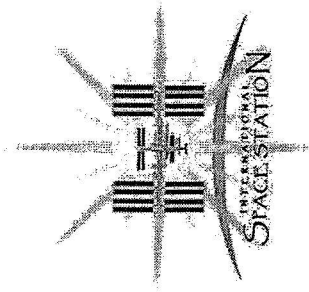
# Example Oversized Item

## SpaceDrums (M03 Bag)

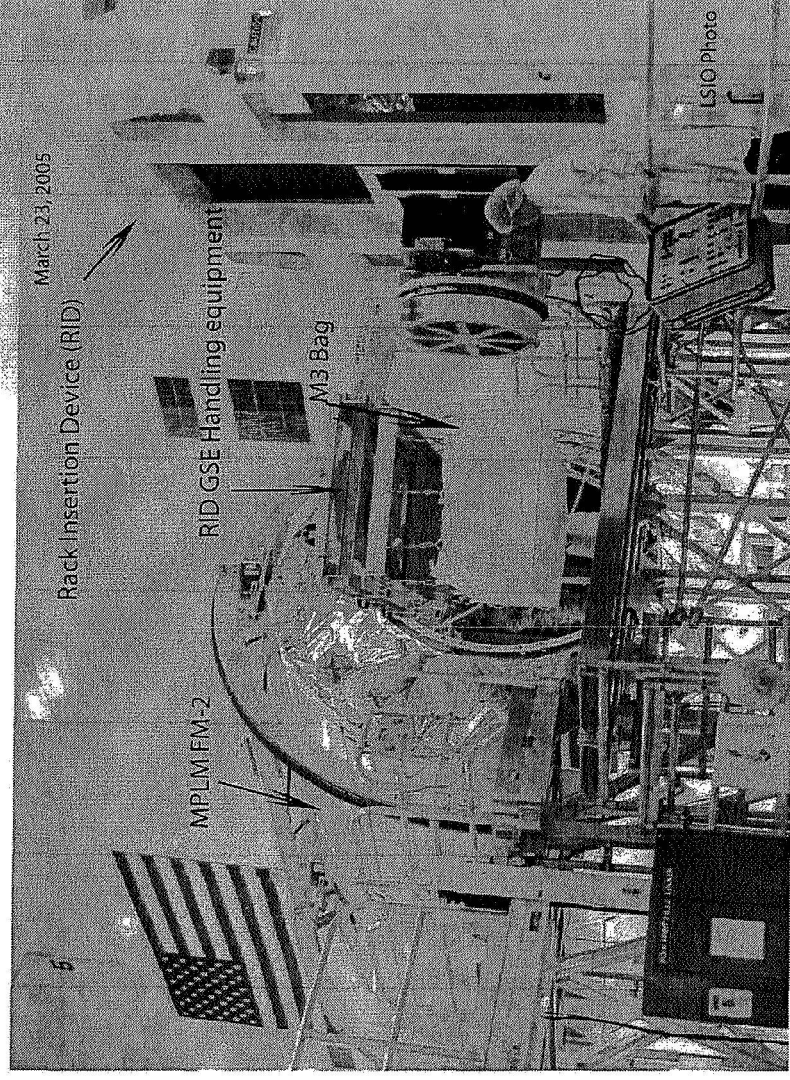
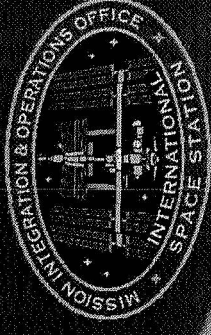
Dimensions: 5.22 CU FT

Mass: 200 lbs



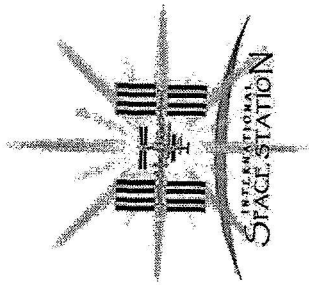


# M03 Bag Installation



- Some oversized hardware/bags may require special FSE.

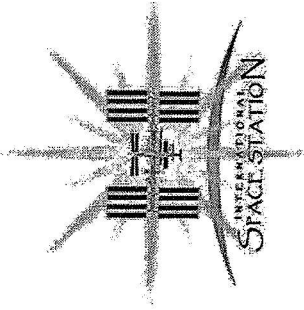




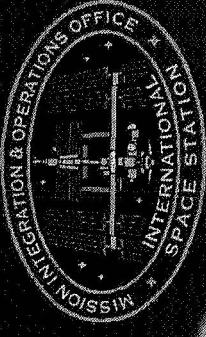
# Standard Unpacked Cargo Items

- Food Containers
- Common Waste Containers

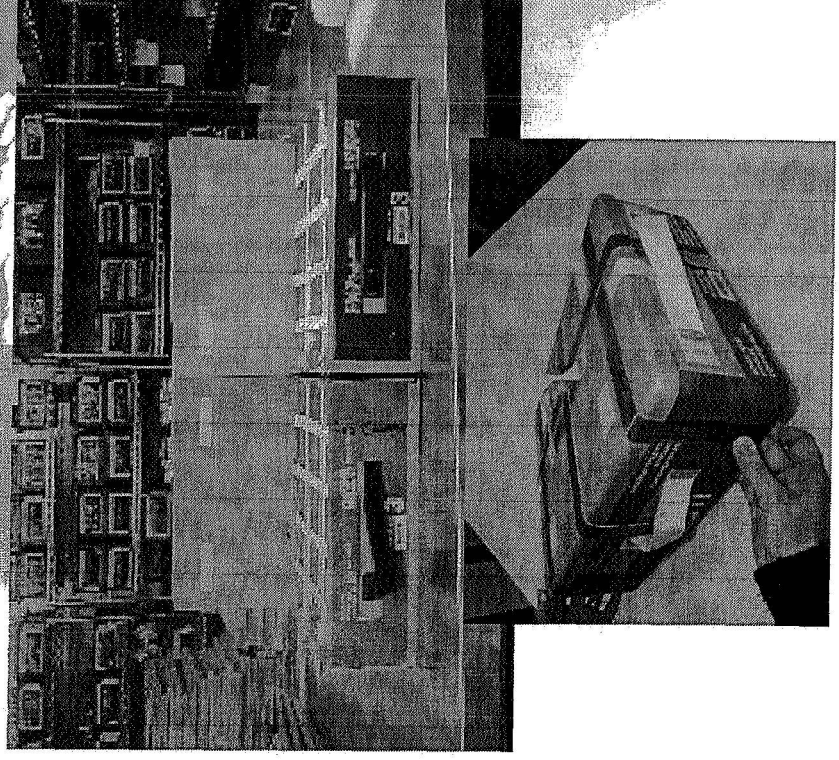


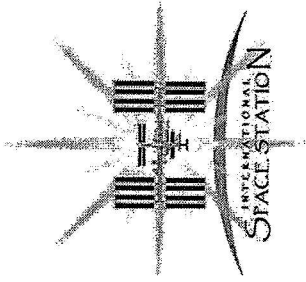


# Food Containers



- Food Containers –
  - US Non-Collapsible, SEG48101834-301  
15" x 12.0" x 4.85"
  - Collapsible, 17KC.260HO 3200-0  
14.875" x 12" x 4.875" (Collapsed)  
14.875" X 12" X .59" (Uncollapsed)
- Mass (Full) – 14.3 lbs
- Mass (Empty) –
  - Non-Collapsible – 3.75 lbs
  - Collapsible – 2.2 lbs



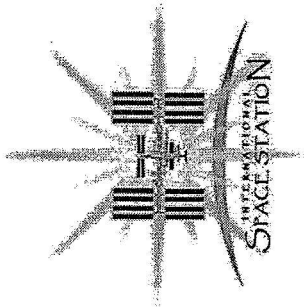


# Standard Waste Containers



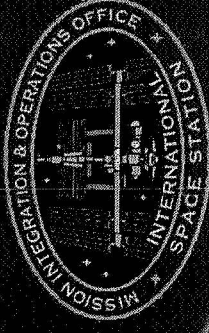
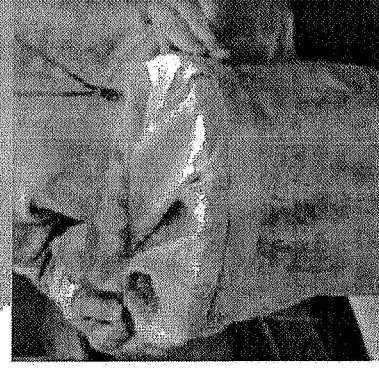
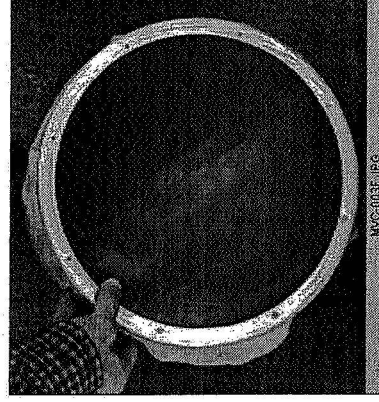
- Bags (compressible)
  - KBO-M generally use for dry trash
  - Table Food Bag (TFB) and/or Rubber-Lined Bag (RLB) used for wet trash
- Human waste containers (hard)
  - EDV and KTO
- Hardware (ORUs, filters, fans, etc.)
  - Odd sizes and shapes

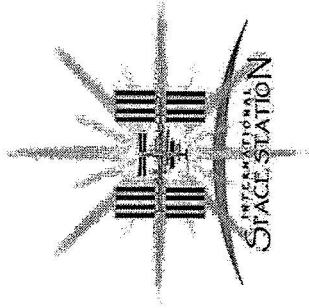




# KBO-M

- Soft Trash Bag, OpNOM: KBO-M
- PN: 11φ 615.8715-OA15-01
- Heavy duty rubberized cloth bag. Metal band around the top and rubber flaps to keep the trash inside.
- Acceptable for undamaged alkaline batteries, some bio waste directly into container – i.e. kleenex; hazardous waste must be properly contained prior to insertion
- Dimensions (Stowed) - 11.75" x 11.75" x 2"
- Dimensions (Full) - 17" long x 11.5" diameter ring x 8" diameter
- Mass (Full) – 17.5 to 20 lbs

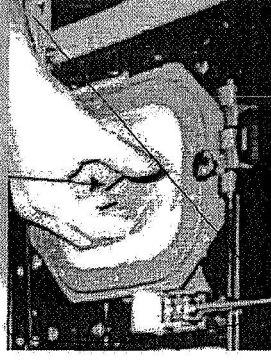
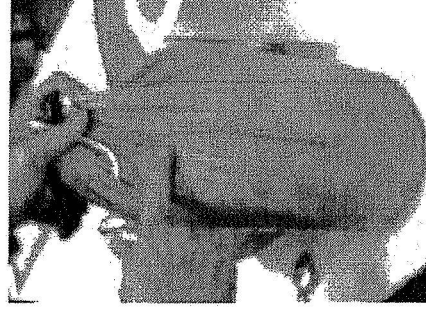
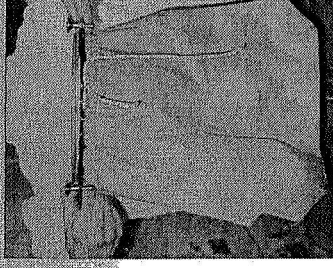


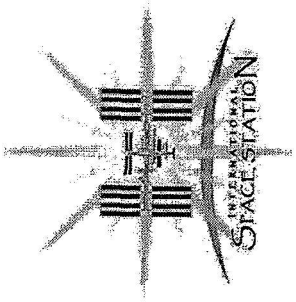


# Food Waste Bag

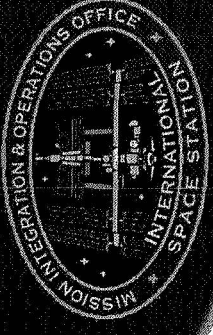


- Food Waste Bag, OpNOM:  
Food Waste Bag  
PN: 11  $\phi$  615.8716-OA15
- Soft, rubberized cloth bag used to place table scraps, and other small wet waste items. This bag can be used for wet or dry trash.
- Dimensions (Stowed) –  
10" x 5" x 0.2"
- Dimensions (Full) –  
8" x 5" diameter
- Mass (Full) – 2 lbs

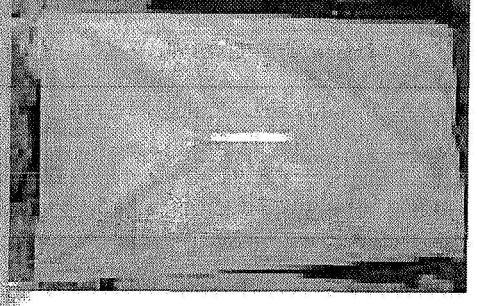
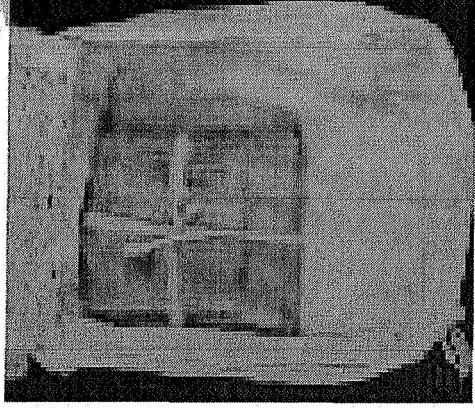




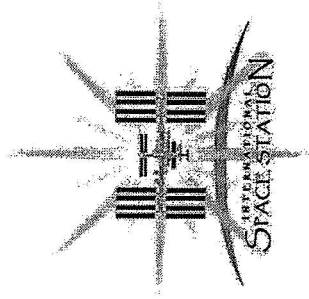
# Rubber Lined Bag



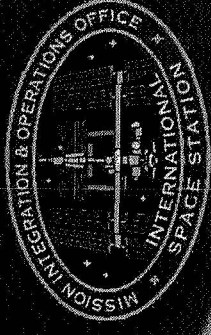
- Rubber Lined Bag, OpNOM: Rubber Lined Bag PN: 11φ615.8716-20A15,
- Rubberized cloth lined bag can contain up to 3 full KBO-M bags or approximately 8 table bags. It has a draw string closure and is nominally closed tighter with the rubber ties known as “szkoo’tee”. Can be wiped down and reused. Preferred by crew for wet trash. Not as heavy duty as the KBO-M, but larger.
- Dimensions (Stowed) - 11.75” x 11.75” x 2.2” (folded around KBO-M)
- Dimensions (Full) – 25” x 15”
- Mass (Full) – 23.7 lbs



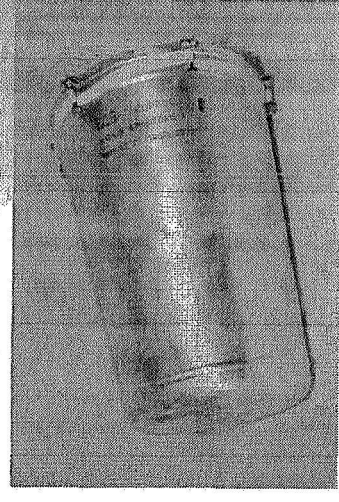
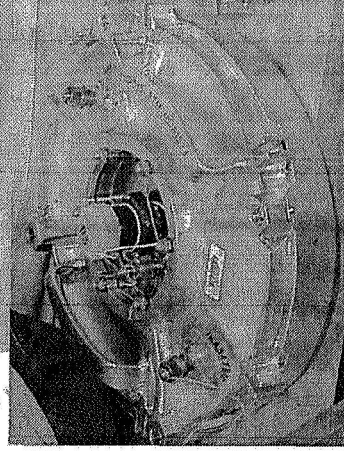
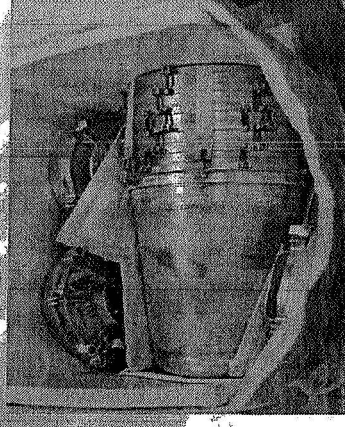


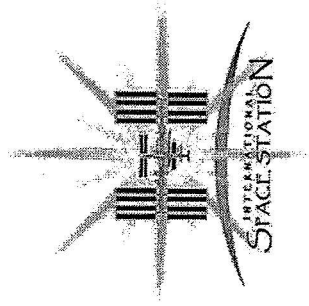


# EDV

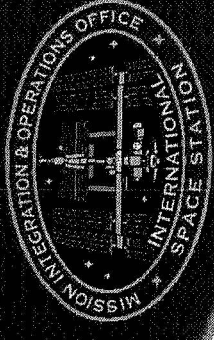


- EDV, OpNOM: EDV  
PN: 11φ 615.8711-0A15-1
- Primarily used for urine and wastewater collection.  
Limited Life: 90-days of on-orbit operations (defined as any operations where the hydro-connector is connected/disconnected).
- Dimensions (Stowed) - EDVs usually launched in set of 6 buckets and separately 6 lids. With rack attachment spike and lid
  - Top - 13.1" (Diameter) x 21.57" (H)
  - Bottom 9" (diameter)
  - EDV Bucket - 17.3" (H) x 13" (Diameter)
  - EDV lid - 4.1" (H) x 13" (Diameter)
- Dimensions (Full) - Without rack attachment spike and lid
  - Top - 13" (Diameter) x 15.7" (H)
  - Bottom - 9" (Diameter)
- Mass (Full) – 58.4 lbs

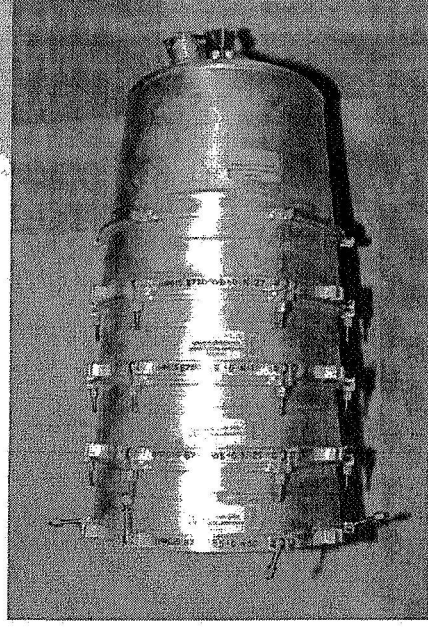




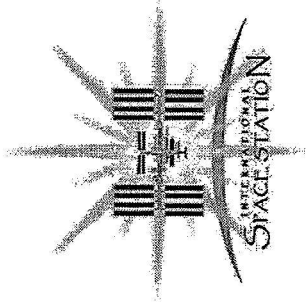
# KTO



- Solid Waste Container, OpNOM: KTO  
PN: 11  $\phi$  615.8720A55-0,
- The KTO is used for solid waste and can contain biological waste.
- Dimensions (Stowed) –
  - Body - 13" (H) x 13 " (diameter)
  - Lid - 2" (H) x 13" diameter
- Dimensions (Full) – 15" (H) x 13" diameter
- Mass (Full) – 25.4 lbs





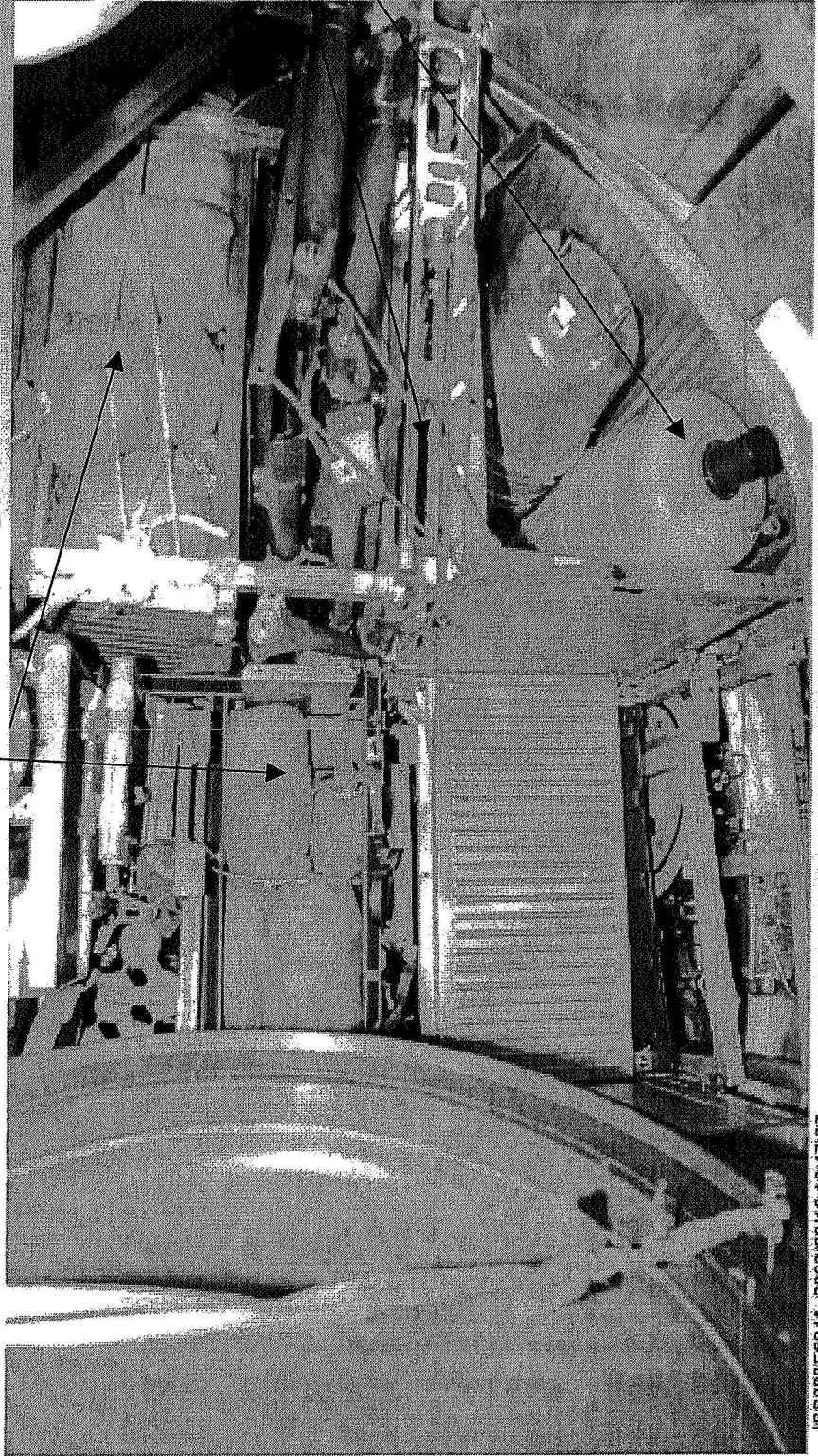


# Example Stowage in Progress for Disposal



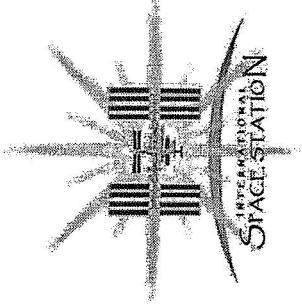
Rubber lined bags

Strapped  
ORUs

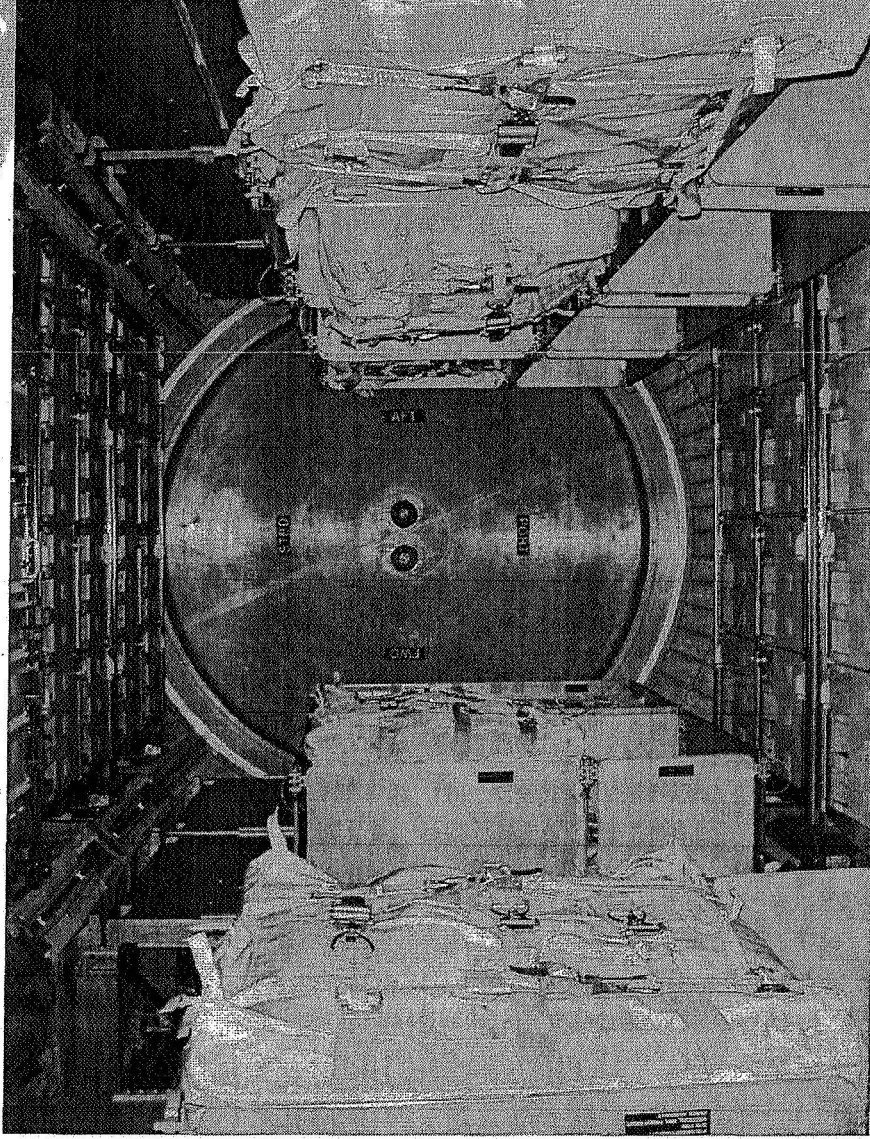


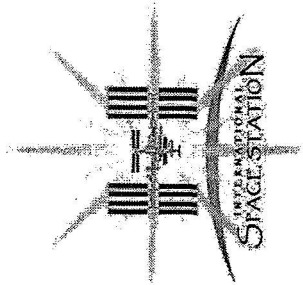
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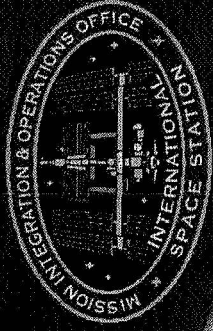


# Example Stowage in MPLM for Launch

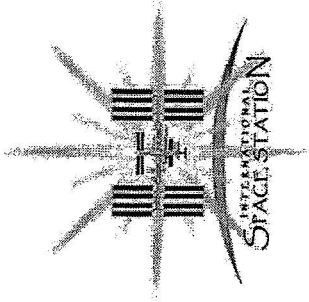




# Historical Delivery Dates for Launch Integration



% Cargo	Delivery Template	Type Cargo
40	Launch minus (L-) 4 to 3 months	All cargo types, Hard mounted items
10	L- 2 months	All size CTBs/Mbags
35	L - 1 month	All size CTBs/5 and 10 MLE bag, some hardmount, Middeck lockers
10	L-2 weeks	All size CTBs/5 and 10 MLE bag, Middeck lockers
5	L-24 to 6 hours	All size CTBs, Middeck lockers

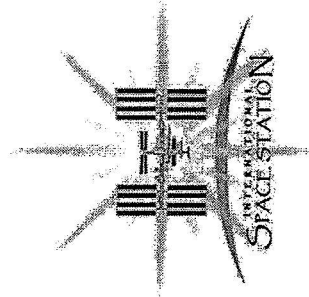


# Estimated Delivery Internal Cargo Types



% Cargo by Item	% Cargo by Volume	Type Cargo
< 5	< 5	Hardmounted Items
15	35	Oversized Items (larger than triple CTB)
75	50	Cargo Transfer Bags (1/2, single, double, triple)
10	10	Non-bag items (food containers, waste containers, etc)



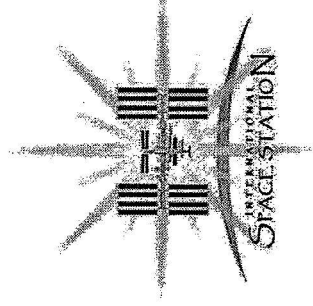


# Historical Cargo Return Data



% Cargo		Return Template	Type Cargo
MAX	MIN		
75	40	Return plus (R+) 2 weeks	All size CTBs, Middeck lockers, All cargo types, Logistics items, Crew preference
15	30	R + 24 hours	All size CTBs, Middeck lockers, CHecs, Payloads
10	30	R+ 4	All size CTBs, Middeck lockers, CHecs, Payloads, Refrigerator/Freezer

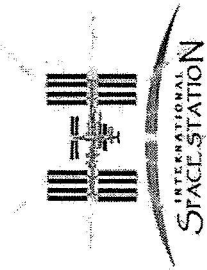
- Typical Return Cargo Types
  - Payload experiments
  - Samples (water, air, blood)
  - Logistics items – inoperable hardware for analysis
  - Crew Health Care Systems (CHecs)
  - Crew Preference Items
- R + 4 Percentages will significantly increase with payload refrigerator/freezer returns



# On-Orbit Estimates for Cargo Transfer



- Cargo operations minimum stay time is based on the time required to unload (Internal and External)
  - Internal Estimates:
    - Typical MPLM flight transfer estimated between 80 and 120 hours transfer (Approximately 200 CTBe) depending on the amount of cargo, that includes transferring the resupply items to ISS and stowing the return items in MPLM.
    - Cannot necessarily increase crew participation to increase hours. Inefficiencies in the operations due to limited working space.
    - Typically no more than 3 - 4 crew members dedicated to transfer
    - Typically no more than 6 hours per day/ 5 days per week.
    - Rack Transfer Estimates – Approximately 2 crew - 1 hour (2 crew hours) together to transfer 1 rack to ISS. Not including connecting up to the ISS utilities
- Maximum stay time is the time to fill the vehicle with waste based on waste generation rates.
  - Increased capability improves operational flexibility

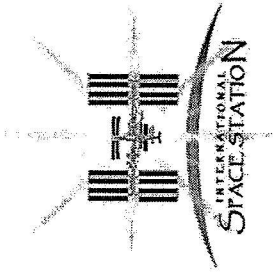


# Historical Delivery Dates for Launch Integration

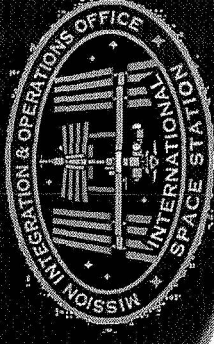


% Cargo	Delivery Template	Type Cargo
40	Launch minus (L-) 4 to 3 months	All cargo types, Hard mounted items
10	L- 2 months	All size CTBs/Mbags
35	L - 1 month	All size CTBs/5 and 10 MLE bag, some hardmount, Middeck lockers
10	L-2 weeks	All size CTBs/5 and 10 MLE bag, Middeck lockers
5	L-24 to 6 hours	All size CTBs, Middeck lockers



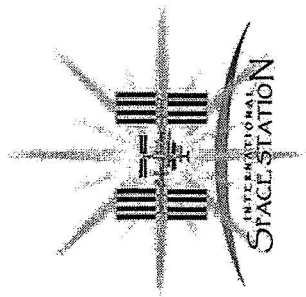


# Historical Cargo Return Data

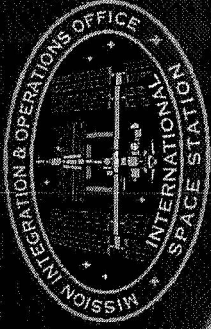


% Cargo		Return Template	Type Cargo
MAX	MIN		
75	40	Return plus (R+) 2 weeks	All size CTBs, Middeck lockers, All cargo types, Logistics items, Crew preference
15	30	R + 24 hours	All size CTBs, Middeck lockers, CHeCS, Payloads
10	30	R+ 4	All size CTBs, Middeck lockers, CHeCS, Payloads, Refrigerator/Freezer

- Typical Return Cargo Types
  - Payload experiments
  - Samples (water, air, blood)
  - Logistics items – inoperable hardware for analysis
  - Crew Health Care Systems (CHeCS)
  - Crew Preference Items
- R + 4 Percentages will significantly increase with payload refrigerator/freezer returns



# Example Soyuz Return Items



Part Name	Part Number	Qty	Planned Disposition	Haz/ Tox	Remarks
RETURN ZIPLOCK BAG ASSY	SEG46118278-702	1	TURNOVER TO HW PROVIDER NLT R + 4 HOURS	N	ZIPLOCK CONTAINS ITCS SAMPLES. DO NOT CRUSH. PROTECT FROM PUNCTURE. DO NOT ALLOW ITEMS TO FREEZE OR EXPOSED TO 49 DEG C OR ABOVE. PACK IN RUBBER LINED BAG (KBO-M) TO AVOID LEAKS.
BAG ASSY., TOC WATER SAMPLE (300 ML)	KL5K270288-308	1	TURNOVER TO HW PROVIDER NLT R + 4 HOURS	Y	CONTAINS SVO-ZV SAMPLE. KEEP TEMP BTWN 41-104 DEG F (5-40 DEG C). DO NOT FREEZE/BEND/CRUSH/PUNCTURE/RIP. PACK IN RUBBER LINED BAG (KBO-M) TO AVOID LEAKS. COVER SEAL OF ZIPLOCK IN GREY TAPE. REFRIGERATE SAMPLES UNTIL PICKUP.
BAG ASSY., TOC WATER SAMPLE (300 ML)	KL5K270288-308	1	TURNOVER TO HW PROVIDER NLT R + 4 HOURS	Y	CONTAINS SRV-K SAMPLE. KEEP TEMP BTWN 41-104 DEG F (5-40 DEG C). DO NOT FREEZE/BEND/CRUSH/PUNCTURE/RIP. PACK IN RUBBER LINED BAG (KBO-M) TO AVOID LEAKS. COVER SEAL OF ZIPLOCK IN GREY TAPE. REFRIGERATE SAMPLES UNTIL PICKUP.
BEARING, GYROSCOPE, GYROSCOPE ASSY - TVIS SYSTEM	SDG46115139-001	2	TURNOVER TO HW PROVIDER NLT R + 14 DAYS	N	NO SPECIAL HANDLING REQUIREMENTS
DUAL SORBENT TUBE ASSEMBLY	SEG46120272-304	12	TURNOVER TO HW PROVIDER NLT R + 12 HOURS	0	DO NOT OPEN TUBES. DO NOT PUNCTURE/CRUSH/BEND BAG. RETURN DUAL SORBENT TUBE ASSYS & DUAL SORBENT TUBE CONTROL ASSYS TOGETHER. PACK WITH AT LEAST 0.5 INCH SOFT PADDING. KEEP TEMP BTWN 0-46 °C (32-114.8°F). TEMP MONITORING REQUIRED.
FORMALDEHYDE MONITOR KIT ASSY	SDD46108168-301	1	TURNOVER TO HW PROVIDER NLT R + 12 HOURS	1	DO NOT BEND/CRUSH/PUNCTURE. PACK WITH AT LEAST 0.5 INCH OF SOFT PADDING TO AVOID CRUSHING. KEEP TEMPERATURE WITHIN -18°C AND 46°C. NOT HAZARDOUS NOR TOXIC.
VALVE ASSEMBLY, GRAB SAMPLER	SDD46108778-301	1	TURNOVER TO HW PROVIDER NLT R + 4 HOURS	0	KEEP TEMP BETWEEN 13 - 46 DEGREES C. PACK ITEM IN AT LEAST 0.5 INCH OF SOFT MATERIAL. PREVENT METAL-TO-METAL CONTACT & SHARP EDGES. AVOID SCRATCHING/PUNCTURE/CRUSHING/BENDING. DO NOT REMOVE KAPTON TAPE OR OPEN VALVE. TEMP MONITORING REQD.
ZIP-LOC BAG, 6X6	528-21039-3	1	TURNOVER TO HW PROVIDER NLT R + 14 DAYS	N	CONTAINS TVIS DEBRIS. KEEP TEMPERATURE BETWEEN -50 AND 50 DEGREES C (-58 TO 122 DEGREES F).